Electronic Version
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Claims

[c1] 1.A television (TV) tuner comprising:
a first mixer for mixing a selected RF signal with a first local oscillator signal to produce an intermediate frequency signal, wherein the selected RF signal is selected via varying the first local oscillator signal;
a second mixer unit for mixing the intermediate frequency signal with a second local oscillator signal for producing an output signal; and
a phase locked loop (PLL) coupled to the first mixer and the second mixer for generating the first local oscillator signal and the second local oscillator signal according to the selected RF signal, wherein the first local oscillator signal and the second local oscillator signal are generated by a single first voltage controlled oscillator (VCO) and a single second VCO respectively.

[c2] 2.The TV tuner of claim 1, wherein the frequency of the second local oscillator signal subtracted from the frequency of the first local oscillator signal is substantially equal to the frequency of the selected RF signal.

[c3] 3.The TV tuner of claim 1, wherein the PLL comprises:
a phase frequency detector (PFD) for comparing a fixed

reference signal with a feedback signal;
a loop filter for filtering the output of the PFD and producing a control voltage;
the single first voltage controlled oscillator (VCO) coupled to the control voltage for generating the first local oscillator signal according to the control voltage;
the second voltage controlled oscillator (VCO) coupled to the control voltage for generating the second local oscillator signal according to the control voltage;
a fourth mixer for mixing the first local oscillator signal with the second local oscillator signal; and
a low-pass filter for filtering the output of the fourth mixer to produce the feedback signal.

[c4] 4. The TV tuner of claim 3, wherein the PLL further comprises a feedback divider for dividing the frequency of the feedback signal by a divide ratio selected according to the selected received RF signal to produce a divided feedback signal to the phase frequency detector.

[c5] 5.The TV tuner of claim 1, wherein the first mixer is a harmonic mixer and the first local oscillator signal includes a first reference signal and a second reference signal, the second reference signal being the first reference signal phase shifted by 90 degrees.

[c6] 6.The TV tuner of claim 1, wherein the second mixer unit

further includes an in-phase mixer for mixing the intermediate frequency signal with an in-phase second local oscillator signal for producing an in-phase baseband output signal, and a quadrature-phase mixer for mixing the intermediate frequency signal with an quadrature-phase second local oscillator signal for producing an quadrature-phase baseband output signal, wherein the quadrature-phase second local oscillator signal is the in-phase second local oscillator signal phase delayed by 90 degrees.

[c7] 7.The TV tuner of claim 6, wherein the in-phase mixer and the quadrature-phase mixer are harmonic mixers; the in-phase second local oscillator signal includes a first reference signal and a second reference signal being the first reference signal phase delayed by 90 degrees, and the quadrature-phase second local oscillator signal includes a third reference signal and a fourth reference signal, the third reference signal being the first reference signal phase shifted by 45 degrees, and the fourth reference signal being the first reference signal phase shifted by 135 degrees.

[c8] 8.A method of processing a received RF signal, the method comprising:
generating a first local oscillator signal using a single first voltage controlled oscillator (VCO) and a second lo-

cal oscillator signal using a single second voltage controlled oscillator using a phase locked loop (PLL) according to a selected RF signal, wherein the selected RF signal is selected via varying the first local oscillator signal;
mixing the selected RF signal with the first local oscillator signal to produce an intermediate frequency signal; and
mixing the intermediate frequency signal with the second local oscillator signal to produce an output signal.

[c9] 9.The method of claim 8, wherein the frequency of the second local oscillator signal subtracted from the frequency of the first local oscillator signal is substantially equal to the frequency of the selected RF signal.

[c10] 10.The method of claim 8, wherein generating the first local oscillator signal and the second local oscillator signal according to the selected RF signal further comprises:
comparing a fixed reference signal with a feedback signal;
producing a control voltage by filtering the result of the comparing;
generating the first local oscillator signal according to the control voltage;
generating the second local oscillator signal according to the control voltage;

mixing the first local oscillator signal with the second local oscillator signal; and
filtering the output of the mixing to produce the feedback signal.

[c11] 11. The method of claim 8, wherein generating the first local oscillator signal and the second local oscillator signal according to the selected RF signal further comprises: dividing the frequency of the feedback signal by a divide ratio according to the selected RF signal.

[c12] 12.The method of claim 8, wherein the first local oscillator signal includes a first reference signal and a second reference signal, and mixing the received RF signal with the first local oscillator signal to produce an intermediate frequency signal comprises harmonically mixing the received RF signal with the first reference signal and the second reference signal, the second reference signal being the first reference signal phase shifted by 90 degrees.

[c13] 13.The method of claim 8, the output signal further includes an in-phase baseband signal and a quadrature-phase baseband signal.

[c14] 14.The method of claim 13, wherein the second local oscillator signal further includes an in-phase second oscil-

lator signal and a quadrature-phase second oscillator signal being the in-phase second oscillator signal shifted by 90 degrees.

[c15] 15. The method of claim 14, wherein the in-phase second oscillator signal further includes a first reference signal and a second reference signal being the first reference signal shifted by 90 degrees, and the quadrature-phase second local oscillator signal includes a third reference signal and a fourth reference signal, the third reference signal being the first reference signal phase shifted by 45 degrees, and the fourth reference signal being the first reference signal phase shifted by 135 degrees.